

WHAT IS CLAIMED IS:

1. A control device for hydraulic, mechanical, and hydraulic-mechanical components, comprising:

a housing (1, 73);

at least one drive element arranged in the housing;

wherein the at least one drive element is a piezo element (12) having a voltage-dependent stroke-force behavior.

2. The device according to claim 1, further comprising a piston (2) arranged in the housing (1), wherein the piezo element (12) directly controls the piston (2).

3. The device according to claim 2, wherein the piezo element (12) engages one end of the piston (2).

4. The device according to claim 1, further comprising a piston (2) arranged in the housing (1), wherein the piezo element (12) indirectly controls the piston (2).

5. The device according to claim 4, further comprising at least one pressure spring (11) arranged in the housing (1), wherein the piezo element (12) engages the piston (2) with interposition of the at least one pressure spring (11).

6. The device according to claim 4, wherein two of the piezo elements (12) are provided, wherein the two piezo elements (12) act indirectly on opposed ends of the piston (2).

7. The device according to claim 6, wherein the piston (2) is configured to be centered by a spring force in a center position when the two piezo elements (12) are not excited.

8. The device according to claim 1, wherein the piezo element (12) is a part of a directional control valve.

9. The device according to claim 8, wherein the directional control valve is directly controlled or pilot-operated.

10. The device according to claim 9, wherein the directional control valve has a valve seat (18) with a through opening (19) and at least one closing element (20), wherein the piezo element (12) actuates the closing element (20) for closing the through opening (19).

11. The device according to claim 10, wherein the directional control valve has a plunger (21) connected to the piezo element (12) and wherein the closing element (20) is provided on the plunger (21).

12. The device according to claim 10, wherein the through opening (19) is arranged centrally in the valve seat (18).

13. The device according to claim 9, further comprising a piston (2) arranged in the housing (1), wherein two of the piezo elements (12) are provided and engage directly the opposed ends of the piston (2)

14. The device according to claim 13, further comprising pilot control valves each comprising one of the piezo elements (12), wherein the pilot control

valves act on the opposed ends of the piston (2), respectively.

15. The device according to claim 14, wherein each piezo element (12) comprises a plunger (21) supporting a closing element (20).

16. The device according to claim 10, wherein the directional control valve has a pressure connector (P, P1, P2) and a tank connector (T), wherein the pressure connector (P, P1, P2) is connected with the tank connector (T) when the through opening (19) is open.

17. The device according to claim 1, wherein the piezo element (12) is configured to control an actuator (31) of an automated manual transmission.

18. The device according to claim 17, wherein the actuator (31) has a lever (33) fixedly connected on a selector shaft (32) and actuator pistons (35) engaging the lever (33) for pivoting the lever (33).

19. The device according to claim 18, wherein the lever (33) has opposed sides and wherein each one of the actuator pistons (35) engages one of the opposed sides, respectively.

20. The device according to claim 19, wherein the actuator pistons are hollow pistons (35).

21. The device according to claim 19, wherein the actuator pistons (35) are loaded by a pressure medium.

22. The device according to claim 19, wherein the actuator (31) has auxiliary pistons (36) and wherein the actuator pistons (35) are moveably arranged in the

auxiliary pistons (36) .

23. The device according to claim 22, wherein the auxiliary pistons (36) have an end position and rest against a casing stop (42), respectively, when in the end position.

24. The device according to claim 22, wherein the actuator pistons (35) have a stop (43), respectively, and wherein the auxiliary pistons (36) are positioned in a movement path of the stop (43) of the pistons (35).

25. The device according to claim 22, wherein the actuator (31) has a casing and wherein the actuator pistons (35) and auxiliary pistons (36) delimited a pressure chamber (37) for the pressure medium in the casing of the actuator (31).

26. The device according to claim 25, wherein the casing of the actuator (31) has a tank line (T) and the pressure chamber (37) is connected to the tank line (T).

27. The device according to claim 26, wherein the actuator (31) has a closing element (20) configured to close the tank line (T), wherein the closing element is adjustable with the piezo element (12).

28. The device according to claim 1, comprising a closing element (20, 44) configured to close a tank line (T) of the device, wherein the closing element is adjustable with the piezo element (12).

29. The device according to claim 28, comprising a valve seat (18) with a through opening (19) arranged in the housing (1), wherein the closing element (20) is a ball which closes a through opening (19) in the valve seat (18).

30. The device according to claim 28, wherein the housing has a through opening (19) and wherein the closing element (4) is a piston connected to the piezo element (12).

31. The device according to claim 30, wherein the closing element (44) closes the through opening (19) either when the piezo element (12) is supplied with current or not supplied with current.

32. The device according to claim 1, wherein the piezo element (12) is a coupling element of a gearshift control.

33. The device according to claim 32, wherein the gearshift control has a gear (50) and a shaft (48), wherein the gear (50) is configured to be fixedly connected with the shaft (48) when the piezo element (12) is supplied with current.

34. The device according to claim 33, wherein the gearshift control has two pressure disks (56, 57), wherein one of the two pressure disks is secured on a first support ring (58) fixedly connected to the shaft (48), wherein the piezo element (12) is positioned between the two pressure disks (56, 57).

35. The device according to claim 34, wherein the gear (50) is seated rotatably on the shaft (48) and has opposed sides provided with a friction pad (52, 53), respectively.

36. The device according to claim 35, wherein, when supplying the piezo element (12) with current, the gear (50) is connected frictionally with the shaft (48) through the friction pads (52, 53) and the first support ring (58) and a second

support ring (54) secured on the shaft (48).

37. The device according to claim 1, wherein the piezo element (12) is part of a clutch (59) comprising clutch disks (69) with friction pads (68), wherein, when the piezo element (12) is supplied with current, the clutch disks (69) either engage one another by friction pads (68) or separate from one another.

38. The device according to claim 37, wherein the piezo element (12) acts onto a thrust bearing (63) of the clutch (59).

39. The device according to claim 37, wherein the clutch (69) is configured to be received in a transmission casing (60) and wherein the piezo element (12) is supported on the transmission casing (60).

40. The device according to claim 37, wherein the clutch (69) has a thrust bearing (63) and wherein several of the piezo elements (12) are provided and distributed about the circumference of the thrust bearing (63).

41. The device according to claim 1, wherein the housing (73) is comprised of a first housing part (73') and a second housing part, wherein the first housing part (73') is movable by the piezo element (12).

42. The device according to claim 41, wherein the first housing part (73') is connected by at least one elastically yielding element (73a) to the second housing part.

43. The device according to claim 42, wherein the elastically yielding element (73a) is a bellows.

cl 37-46
OK 10-12-90
HUB
2001

10057293.012500

44. The device according to claim 41, wherein the piezo element (12) has a first end resting against the first housing part (73') and a second end resting against the second housing part.

45. The device according to claim 41, further comprising an external casing (76), wherein the housing (73) is arranged in the external casing (76).

46. The device according to claim 44, wherein the external casing (76) has a valve seat (77) with a through opening (19), wherein the housing (73) has a closing element (20) configured to close the through opening (19) of the valve seat (18).

47. The device according to claim 46, wherein the housing (73) has an end face provided with a plunger (75), wherein the closing element (20) is connected to the plunger (75).